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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/576,721	01/26/2007	Yoshikatsu Seino	290087US0PCT	4373
22850 7590 12/22/2010 OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER CHAN, HENG M				
ART UNIT		PAPER NUMBER		
1728				
NOTIFICATION DATE		DELIVERY MODE		
12/22/2010		ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/576,721

Applicant(s)

SEINO ET AL.

Examiner

HENG M. CHAN

Art Unit

1728

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 July 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2 and 4-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, and 4-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-940)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7/6/2010 has been entered.

Claims 1, 2, and 4-18 are pending.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 1, 2, 4, 9-13, 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 07-330312 by Koyama et al., in view of US Patent No. 6,503,473 by Akiba.**

Regarding claim 1, Koyama et al. teach a method of producing a highly pure lithium sulfide by reacting lithium hydroxide with hydrogen sulfide in an aprotic organic solvent, and washing the lithium sulfide with an aprotic organic solvent such as N-methyl-2-pyrrolidone (NMP) (abstract; claims 1-2; [0035-0038]).

Koyoma et al. do not expressly teach that the temperature of the washing solvent is 100°C or higher.

Akiba also relates to the production of lithium sulfide from a reaction between lithium hydroxide and hydrogen sulfide in an aprotic organic solvent such as NMP and teaches washing a crystal cake resulting from the reaction with the aprotic organic solvent at a temperature preferably from 50 to 120°C, for example, 100°C, in order to recover lithium hydrosulfide (abstract; column 2, lines 12-21; column 6, lines 21-28; Comparative Example 2).

It would have been obvious to one of ordinary skill in the art at time of invention to have washed lithium sulfide with NMP at a temperature of 100°C or higher in the method of Koyoma et al., motivated by the fact that Akiba teaches that the viscosity of the aprotic solvent depends on the temperature and that the solubility of lithium sulfide in the aprotic organic solvent such as NMP decreases as the temperature increases over the range of 50-150°C (column 5, lines 1-45; column 6, lines 21-28). Therefore, the skilled artisan would have optimized the temperature of the washing solvent (NMP) in order to avoid poor washing efficiency due to the viscosity of the solvent and retain the lithium sulfide solid product while removing soluble impurities such as lithium hydrosulfide.

Regarding claims 2, 14, and 16, Koyama et al. teach that the organic solvent used for washing is an aprotic polar solvent, e.g. NMP, and that it is identical to the aprotic organic solvent in said reaction ([0010-11]; [0035-0038]).

Regarding claim 9, the limitations of the instant claim are taught by Koyama et al. and Akiba or would have been obvious modifications of the prior arts within the ability of one of ordinary skill in the art. Koyama et al. teach reacting lithium hydroxide with hydrogen sulfide at a temperature of 0-150°C in an aprotic organic solvent to obtain a lithium sulfide; removing the aprotic organic solvent to provide a solid lithium sulfide; adding a fresh aprotic organic solvent to the solid lithium sulfide to wash the solid lithium sulfide; and drying the lithium sulfide at presumably a normal pressure ([0035-38]). Akiba teaches that solid liquid separation after the reaction is done by filtration, centrifugal separation, and the like, at a temperature preferably from 50-150°C (from column 4, line 61 to column 5, line 14). A separation technique such as centrifugal separation would have involved decantation, i.e. pouring off the solvent to separate the solid. Akiba also teaches that washing is done by dispersing the solid in an aprotic organic solvent and stirring the dispersion at a temperature preferably from 50-120°C (from column 5, line 61 to column 6, line 28). The skilled artisan would have optimized the temperature at which the aprotic organic solvent is removed and the lithium sulfide washed in order avoid poor washing efficiency due to the viscosity of the solvent and retain the lithium sulfide solid product while removing soluble impurities such as lithium hydrosulfide. The skilled artisan would have removed the aprotic organic solvent and dried the stirred dispersion of lithium sulfide under a stream of inert gas in order to avoid unwanted side reactions such as oxidation as Akiba suggests that oxidation could happen to produce a sulfur oxide of lithium, increasing the recovering loss of lithium compounds (column 6, lines 35-40).

Regarding claims 4, 10-13, 17, and 18, Koyama et al. teach that the purity of the lithium sulfide is not less than 99.8% ([0036]; [0038]). The lack of mentioning of the contents of sulfur oxides and lithium N-methylaminobutyrate (LMAB) suggests that no such impurities were present (i.e. 0% by weight).

Regarding claim 15, Akiba teaching washing with an aprotic organic solvent such as NMP at a temperature preferably from 50 to 120°C, for example, 100°C (column 6, lines 21-28; Comparative Example 2). This temperature is lower than the boiling temperature of the organic solvent.

3. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koyama et al. and Akiba as applied to claim 4 above, in view of US 2004/0109940 by Kugai et al.

Regarding claims 5-8, Koyama et al. teach using lithium sulfide in the fields of electricity, electronics ([0001]).

Koyama et al. do not expressly teach a solid electrolyte for a lithium rechargeable battery comprising the lithium sulfide as per claim 5 or a solid electrolyte for a lithium rechargeable battery wherein the ionic conductance is 1×10^{-3} S/cm or higher as per claim 6.

Kugai et al. also relate to lithium sulfide (Li_2S) and teach a solid electrolyte comprising lithium sulfide and a lithium secondary cell comprising the solid electrolyte (abstract; [0018]). Kugai et al. also teach that the solid electrolyte preferably has an

ionic conductance of at least 1×10^{-4} S/cm, preferably from 5×10^{-4} S/cm to 2.5×10^{-3} S/cm ([0024]).

It would have been obvious to one of ordinary skill in the art at time of invention to have applied the lithium sulfide of Koyama et al. to useful applications such as a solid electrolyte and a lithium rechargeable battery comprising the electrolyte as suggested by Kugai et al. because the skilled artisan would have appreciated its properties including ionic conductance in these applications ([0006]; [0018]; [0024]).

Response to Arguments

4. Applicant's arguments filed 7/6/2010 have been fully considered but they are not persuasive. The instant application has been transferred to a new Examiner and the Examiner has found that the incorporation of the previous claim 3 into claim 1 was insufficient to overcome the prior art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HENG M. CHAN whose telephone number is (571)270-5859. The examiner can normally be reached on Monday to Friday, 9:30 am EST to 6:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer K. Michener can be reached on (571)272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer K. Michener/
Supervisory Patent Examiner, Art Unit 1728

/HENG M CHAN/
Examiner, Art Unit 1728